

REMARKS

Claims 1-25 are pending in the present application. Claims 14-21 are withdrawn from consideration.

Claim 1 was rejected under 35 U.S.C. 103(a) as being unpatentable over Kerner et al. (U.S. Patent No. 4,212,855) in view of Masseling et al. (U.S. Patent No. 5,194,239).

Claims 2-10 and 12-13 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kerner et al. in view of Masseling et al. as applied to claim 1 above, and further in view of Winkler et al. (U.S. Patent No. 6,500,402).

Claim 11 was rejected under 35 U.S.C. 103(a) as being unpatentable over Kerner et al. in view of Masseling et al. and Winkler et al. as applied to claim 9 above, and further in view of Senjo et al. (U.S. Patent No. 4,061,743).

Claim 1 has now been amended. No new matter has been added. Reconsideration of the application in view of the above amendments and following remarks is respectfully requested.

Telephonic Interview of September 2, 2009

The Applicants thank the Examiner for the telephonic interview of September 2, 2009. During said interview, Applicants provided information on the features distinguishing claim 1, as amended in Applicants' response dated May 22, 2009 to the Office Action dated January 22, 2009, from Kerner et al. (U.S. Patent No. 4,212,855) and Masseling et al. (U.S. Patent No. 5,194,239). The Applicants argued that neither Kerner nor Masseling teach or suggest returning, to a first contact stage, a partial stream of SO₂ and SO₃ withdrawn from a contact stage and mixed with feed gas as recited in claim 1 of the present application. The Applicants also discussed the amount of SO₃ gas withdrawn from the contact stage located upstream of the last main contact stage in the

present application as compared to the essentially free of SO_3 gas recycled in the non-catalytic system in Masseling. The features the Applicants identified to the Examiner as patentably distinguishing claim 1 of the present application over Kerner and Masseling are also included in the arguments below.

Rejections under 35 U.S.C. § 103(a)

Claim 1 was rejected under 35 U.S.C. § 102(a) as being unpatentable over Kerner et al. (US 4,212,855) in view of Masseling et al. (US 5,194,239). Claims 2-10 and 12-13 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kerner et al. in view of Masseling et al. as applied to claim 1 above, and further in view of Winkler et al. (U.S. Patent No. 6,500,402). Claim 11 was rejected under 35 U.S.C. 103(a) as being unpatentable over Kerner et al. in view of Masseling et al. and Winkler et al. as applied to claim 9 above, and further in view of Senjo et al. (U.S. Patent No. 4,061,743).

Kerner describes a process for the production of concentrated sulphuric acid. An H_2S -containing gas 3 is fed together with air 4 into a combustion furnace 2 where the H_2S -containing gas is burned to form a moist SO_2 -containing gas. Part of the moist SO_2 -containing gas flows into a cooling tower 6 where it is cooled and recycled back via line 11 to combustion furnace 2. See Kerner, column 1, lines 6-9, column 4, lines 29-32 and Fig. 1.

Masseling describes an oxygen-based noncatalytic process to produce sulphuric acid. Molten sulphur in line 10 is fed together with oxygen in line 12 into a sulphur combustion zone 16 where the sulphur is combusted to yield SO_2 , SO_3 and inerts. The SO_2 , SO_3 and inerts are then passed into sulphur trioxide absorption zone 20 where essentially all the SO_3 is removed as sulfuric acid. The effluent gas stream from sulphur trioxide absorption zone 20, consisting mainly of SO_2 , CO_2 , O_2 and inerts, is in part purged from the system via line 22 and in part recycled back to the sulphur combustion zone 16. See Masseling, the title, column 4, lines 39-68 and Fig. 1.

Winkler describes a high temperature catalyst for reacting SO_2 with oxygen to form SO_3 . The catalyst, which is suited for a continuous operation at temperatures of 700°C and above, comprises a porous carrier and an active component connected with the carrier, where the active

component consists of 10 to 80 wt.-% iron, the carrier has a BET surface of 100 to 2000 m²/g and an SiO₂ content of at least 90 wt.-%, and the weight ratio of the carrier:active component lies in the range from 1:1 to 100:1. See Winkler, the abstract, column 1, lines 47-52 and column 3, lines 23-38.

Senjo describes a wet type exhaust gas scrubbing process for removing nitrogen oxides (NO_x) containing nitrogen monoxide and nitrogen dioxide from exhaust gases by oxidizing nitrogen monoxide into nitrogen dioxide and/or dinitrogen trioxide first and then by scrubbing the exhaust gases with an aqueous scrubbing suspension containing the sulfite of alkaline earth metal in a scrubbing column. See Senjo, column 1, lines 4-18.

Independent claim 1 of the present application recites a process for the production of sulphuric acid, including:

“withdrawing a partial stream of the sulphur dioxide and sulphur trioxide-containing gas from a contact stage located upstream of the last main contact stage,

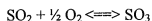
mixing said partial stream with the feed gas to form a contact gas having a sulphur dioxide content of more than 13 % by volume, and

returning said mixed partial stream to the first contact stage, wherein the contact stages contain a catalyst.”

It is respectfully submitted that neither Kerner nor Masseling teach or suggest returning, to a first contact stage, a partial stream of SO₂ and SO₃ withdrawn from a contact stage and mixed with feed gas as recited in claim 1. In contrast, in one variation Kerner merely recycles via line 11 cooled SO₂-containing gas back to combustion furnace 2. See Kerner, column 4, lines 29-32 and Fig. 1. In another variation, Kerner merely feeds SO₂ circulated from an intermediate absorption tower 114 via line 22 to a last contact stage 112. See Kerner, column 4, line 63 to column 5, line 9 and Fig. 2. Kerner does not mix any partial stream of SO₂ and SO₃ with feed gas. Masseling does not cure this defect. In contrast, Masseling merely recycles via line 24 an effluent gas stream containing mainly SO₂ back to sulfur burner 16. See Masseling, column 4, lines 64-68. Masseling thus does not return any partial stream of SO₂ and SO₃ to any contact stage at all. Indeed, Masseling

has no contact stages or specifically catalyst-containing stages, as required by claim 1, as Masseling describes a completely different non-catalytic process.

As described in the present Specification, overheating of the catalyst in the first contact stage will be reliably avoided despite the application of a contact gas containing more than 13 % by volume of sulfur dioxide, because the sulfur trioxide introduced via the re-circulated partial stream shifts the thermodynamic equilibrium of the oxidation reaction



towards the educts, enabling a lower conversion and resulting in a lower gas temperature at the exit of the contact stage. See Specification, page 3, line 26 to page 4, line 5. Kerner and Masseling do not address the catalyst overheating problem, and indeed describe processes completely different from the recited sulfuric acid production method. Nor does either of Winker or Senjo teach or suggest the features of claim 1 missing from Kerner and Masseling.

Moreover, Independent claim 1 of the present application has now been amended so as to recite a process for the production of sulphuric acid “wherein the partial stream withdrawn from the contact stage located upstream of the last main contact stage has a sulphur trioxide content of from about 9 % by volume to about 21 % by volume.” Support for this amendment may be found in the Specification, for example, on page 27, Table 1, under “19 Recirculation gas” where Example 4 lists 8.9 % SO₃ by volume and Example 3 lists 20.99 % SO₃ by volume. The Applicants respectfully point out that the numbering in Table 1 reflects the numbering in the Figures. The “19” in Table 1 therefore refers to the recirculation duct in Figures 2-8 whereby the partial stream of the sulphur dioxide and sulphur trioxide-containing gas is withdrawn from a contact stage located upstream of the last main contact stage, which partial stream is then mixed with the feed gas to form a contact gas, which mixed partial stream is then returned to the first contact stage.

It is respectfully submitted that none of Kerner, Masseling, Winkler and Senjo teach or suggest withdrawing a partial stream with a sulphur trioxide content of from about 9 % by volume to about 21 % by volume from the contact stage located upstream of the last main contact stage,

mixing said partial stream with the feed gas to form a contact gas, and returning said mixed partial stream to the first contact stage as recited in amended claim 1. In contrast, as set forth above, in one variation Kerner merely recycles via line 11 cooled SO₂-containing gas back to combustion furnace 2. See Kerner, column 4, lines 29-32 and Fig. 1. In another variation, Kerner merely feeds SO₂ circulated from an intermediate absorption tower 114 via line 22 to a last contact stage 112. See Kerner, column 4, line 63 to column 5, line 9 and Fig. 2. Kerner therefore does not recycle any SO₂-containing gas at all. Masseling does not cure this defect. In contrast, the product gas stream Masseling passes into sulphur trioxide absorption zone 20 has:

“essentially all the formed sulfur trioxide removed from the gas stream as sulfuric acid. The effluent gas stream from the absorption zone 20 is essentially free of sulfur trioxide and consists mainly of sulfur dioxide, inerts, and small amounts of oxygen and carbon dioxide.”

Emphasis added. See Masseling, column 4, lines 56-62. As stated above, Masseling also does not return any partial stream of SO₂ and SO₃ to any contact stage at all because Masseling has no contact stages or specifically catalyst-containing stages, as required by claim 1. Masseling describes a completely different non-catalytic process. See Masseling, the Title and the Abstract. Nor does either of Winker or Senjo teach or suggest that the partial stream withdrawn from the contact stage located upstream of the last main contact stage has a sulphur trioxide content of from about 9 % by volume to about 21 % by volume.

Because each of Kerner, Masseling, Winkler and Senjo fail to teach or suggest the above-recited features of amended claim 1, any combination of these references, to the extent proper, could not render claim 1 or any of its dependent claims obvious.

For the above reasons, reconsideration and withdrawal of the respective rejections of claims 1-13 under 35 U.S.C. § 103(a) based on a respective combination of Kerner, Masseling and Winkler is respectfully requested.

CONCLUSION

In view of the above amendments, Applicants believe the pending application is in condition for allowance.

The Commissioner is hereby authorized to charge any unpaid fees deemed required in connection with this submission, including any additional filing or application processing fees required under 37 C.F.R. §1.16 or 1.17, or to credit any overpayment, to Deposit Account No. 04-0100.

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Respectfully submitted,

By *N-B. Thot*
Norman B. Thot

Registration No.: 47,993
DARBY & DARBY P.C.
P.O. Box 770
Church Street Station
New York, New York 10008-0770
(212) 527-7700
(212) 527-7701 (Fax)
Attorneys/Agents For Applicants